B) AMENDMENTS TO SPECIFICATIONS

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The waveguide probe (38) is aligned and soldered or welded to the end of the first part (7) of the pin extending outside the housing, as shown in Fig. 1(b). After this, a section of waveguide (31), having two broad side walls (32,33) and an end wall (34), is aligned and mounted to the exterior major wall (28) of the housing (20). It is noted that a portion of the broad side wall (32) of the waveguide has been removed whereas the other broad side wall (33) is intact, so that when the section of waveguide is mounted and attached to the housing, a complete waveguide cavity (35) is formed. The end wall (34) of the section of waveguide is adjusted so that the distance (36) between the end wall (34) and the central line (37) of the waveguide probe is substantially equal to a quarter of the wavelength of the microwave signals (39) to be propagated. **<u>Fig. 1(c) shows a prior art waveguide probe (38) with a main probe body (30) and a slot (16). The slot has an axis (15) for connection to the first part (7) of central metal pin (2). According to the prior art structure, the electric field or E-field (39') of the microwave signals (39) will be perpendicular to the broad side walls (32,33) or parallel to broad walls (20b) defining a reference plane as depicted in Fig. 3(a).</u>**

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To form a microwave end launcher with controlled polarization and improved frequency bandwidth, the non-symmetrical waveguide probe (40) is mounted at one end (7) of the pin of a feedthrough (1), as shown in Fig. 3(a). The feedthrough is mounted in a major wall (28) of a conductive housing (20). The conductive housing has two broad walls (20b), a major exterior wall (28a) and is formed by metals or alloys. There are threaded holes (20a) for the mounting of a waveguide section. The long axis (42a) of the second arm (40) of an L-shape non-symmetrical waveguide probe is aligned to be

substantially parallel to the major exterior wall (28a). Inside the conductive housing there are MMICs and components. To facilitate the mounting of a waveguide section (50, in Fig. 3(c)) for receiving and guiding the microwave signals excited by the non-symmetrical waveguide probe, a universal launcher adapter (51', Fig. 3(b) or 51 in Fig. 3(d)) is provided. The universal launcher adapter **(51) as shown in Fig. 3(d)** is constructed by metals, alloys or plastic materials with layers of metals coated on all walls. A through channel (52) is arranged in the center **region** of the broad wall (53). The through channel is defined by two long walls (55), defining a height (55a), and two short walls (54), defining a width (54a). Both the width (54a) and height (55a) of the through channel are selected to be the same as that for the inner cavity (58) of the waveguide section (50) used, which has two broad waveguide walls (56) **as shown in Fig. 3(c)**. **To facilitate the mounting of the universal launcher adaptor (51) to the major exterior wall (28a Fig. 3(a)), two screw holes (51b) are provided in adaptor (51) and two threaded holes (20a) are provided in the major exterior wall (28a). To allow the mounting of the waveguide section (50) to the universal launcher adaptor (51), threaded holes (51a, 51b') are provided. Here threaded holes (51a) are aligned to screw holes (50a) in a flange (50b) in the waveguide section (50 Fig. 3(c)). The waveguide section (50) has a waveguide (50') with two broad walls (56) and two narrow walls (56') defining a waveguide channel (56). Dimensions of cross-section of the waveguide channel (56) are substantially the same as those of the through channel (52) in the universal launcher adaptor (51). The universal launcher adapter (51') in Fig. 3(c) is similar to that of the adaptor (51) and is constructed by metals, alloys or plastic materials with layers of metals coated on all walls. A through channel (52) is arranged in the centeral region of the broad wall (53). The through channel is defined by two long walls (55), defining a height (55a), and two short walls (54), defining a width (54a). Both the width (54a) and height (55a) of the through channel are selected to be the same as that for the inner cavity (58) of the waveguide section (50) used, which has two broad waveguide walls (56). To facilitate the mounting of the universal launcher adaptor (51') to the major exterior wall (28a Fig. 3(a)), two screw holes (51b') are provided. To allow the mounting of the**

waveguide section (50) to the universal launcher adaptor (51), threaded holes (51a, 51b') are provided. Here threaded holes (51a) are aligned to screw holes (50a) in the flange (50b) in the waveguide section (50 Fig. 3(c)). It is noted that the universal launcher adaptor (51) is similar to the universal launcher adaptor (51') except that the long walls (55) for **adaptor** (51) are perpendicular the long walls (55) of **adaptor** (51'). By providing a precision slot (54s in Fig. 3(e)) in one of the two short walls, the universal launcher adapter also serves as a universal impedance transformation section. Another universal lunched adapter (51'') may also be connected to the same universal conductive housing **as shown in Fig. 3(a).**

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Referring to Fig. 4(a) - 4(d), which provide flow diagrams of main fabrication steps and photo mask patterns, the fabrication of precision L-shape waveguide probes according to a second embodiment of this invention is performed as follows. As shown in Fig. 4(a), a brass substrate (60) with a thickness of about 10 mil is first solvent cleaned and baked dry. The thickness of the substrate 10 mil is selected to be the same as the diameter of central pin (7 in Fig. 3(a)) to facilitate the subsequent attachment of the waveguide probe to the pin. Although the value of 10 mil is given as an example for the substrate thickness, substrates with thickness other than 10 mil such as in a range 50 micrometers to 400 micrometers may be used. A first photoresist layer (61) of a thickness about 1-2 micrometers is then applied on the front surface and a second photoresist layer (62) is applied on the back surface of the brass substrate. After a soft baking at 90°C for 10 minutes, the first photoresist layer (61) on the front surface is exposed to UV light through a first photo mask (63) while the second photoresist layer on the back surface is unexposed. It is noted that the purpose of the second photoresist layer is for protection of the substrate during subsequent etching. The first photo mask contains opaque regions (64) and transparent regions (65). These regions are designed so that a plurality of waveguide probes can be formed on a brass substrate in one fabrication run. A positive tone photoresist such as AZ-1820 from Shipley Company, Massachusetts may be used. Since AZ-1820 is a positive tone photoresist, the opaque regions (64) define the

dimensions and shape of the non-symmetrical waveguide probes. According to this invention, it is preferred to connect all of the waveguide probes together electrically to facilitate the electrodeposition of Au or Ag layer. Fig. 4(b) shows a top view of the patterns on the first photomask used. To simplify the explanation, the first photomask provided contains nine non-symmetrical waveguide probe patterns (40a). Each of the waveguide probe patterns is connected electrically to adjacent four waveguide probe patterns by fine wire patterns (66a, 66b). The purpose of the fine wire patterns is to create fine brass wires after etching to provide electrical connection, to facilitate the electrodeposition of Au or Ag. Furthermore, a slot pattern (67a) is created in each waveguide probe pattern (40a). Hence after etching, a slot (67 in Fig. 4(e)) will be created in each non-symmetrical waveguide probe. This slot will allow the attachment of a waveguide probe to the end of the first part of pin (7) of the feedthrough as shown in Fig. 3(a). It is noted that the width (77a) of the slot pattern (67a) is selected so that after etching, the width (77 in Fig. 4(d)) of slot in the formed waveguide probe is slightly greater than the diameter of the pin (7) shown in Fig. 3(a).

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After development of the photoresist on the front surface, the patterns on the first photomask shown in Fig. 4(b) is transferred onto the first photoresist layer with exposed brass regions and unexposed brass regions. The brass substrate with the photoresist patterns is then baked at 110°C for 20 minutes. After this hard baking, exposed brass regions are etched by immersing the substrate in an etching solution containing ferric chloride, $FeCl_3$. Typical time required to etch through the 10 mil thick brass is about two minutes at room temperature. It is noted that the etching time may be reduced by agitating the solution or by increasing the solution temperature. It is further noted that the final dimensions of each waveguide probe are determined firstly by the dimensions of patterns in the photomask and secondly by the etching of the brass substrate. Since the dimensions of each prior art waveguide probes must be controlled precisely during the mechanical machining, the time required is long and the fabrication cost is high. Fig. 4(c) shows a cross-sectional view of the brass substrate after the etching. **<u>Each of the L-shape</u>**

waveguide probes (40) formed is covered by a photoresist pattern (40a). It is noted that due to the etching, there is an edge recess or undercutting (U) in the peripheral regions for each waveguide probes (40). ~~Here, L-shape waveguide probes (40) are created by the etching~~. For clarity, the fine brass wires and fine photoresist patterns defining the fine brass wires (66, 66b') given in Fig. 4(d) are not shown. After this, the remaining photoresist patterns (69) and the photoresist (62) on the back surfaces of the waveguide probes are removed by immersing the substrate in acetone. This is followed by a rinse in de-ionized water. Fig. 4(d) is a schematic top view of the waveguide probes fabricated and before separation. It is noted that each L-shape waveguide probe (40) is connected to adjacent waveguide probes by fine brass wires (66, 66b'). It is noted that one slot (67) has been created for each L-shape waveguide probe for alignment purposes. A layer of gold is now plated over the surfaces of each waveguide probe while all of the waveguide probes are still connected together electrically. This is done by attaching one part of the connected waveguide probes to the cathode of an Au electrodeposition system (not shown) to deposit an Au layer with a thickness of 1-5 micrometers. The purposes of the Au layer are to increase the surface conductivity of the waveguide probes and to facilitate the attachment to the pin. After the Au deposition, the waveguide probes are rinsed in de-ionized water and dried. The fine brass wires (66, 66b') connecting adjacent waveguide probes are finally cut to isolate one waveguide probe from the others.